ICE AND FROST

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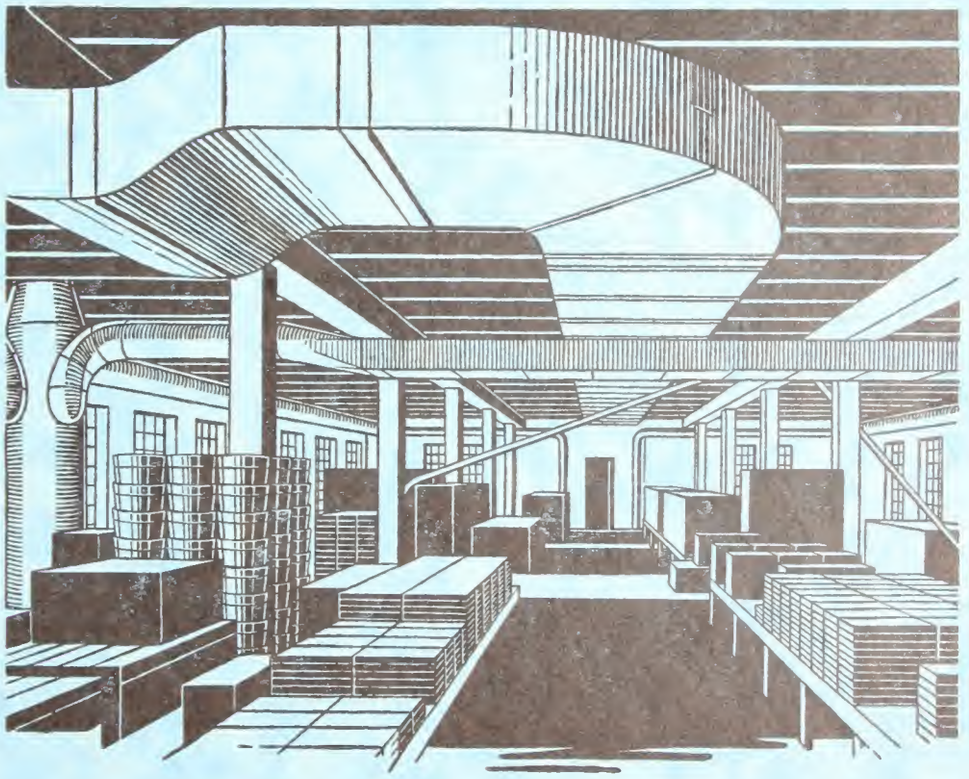


The Standard Caramel Co., at Lancaster, Penna., has used Frick Air Conditioning since 1910.

Bulletin
No. 505-B

Frick Systems of
Air Conditioning

Air Conditioning Systems

THE methods now being offered to the public under the name of "Air Conditioning" are so many and so varied, that owners and contractors tend to become confused as to what represents good practice. This bulletin is presented with the hope of drawing attention to the air conditioning systems that have been shown to give satisfactory results when installed by capable contractors, under the direction of experienced engineers. It will serve as a guide in the selection and use of these systems.

As is well known, Frick Company has been closely related to refrigeration in all its phases since the early eighties. Included in this activity on the part of Frick Company has been a great deal of work in air conditioning. The first air conditioning installations made by Frick Company date back 30 or 40 years ago. These were installed in industrial plants where accurate control of air properties was necessary for economical manufacture. The air conditioning system of today is based on the same fundamental principles that have been used for decades.

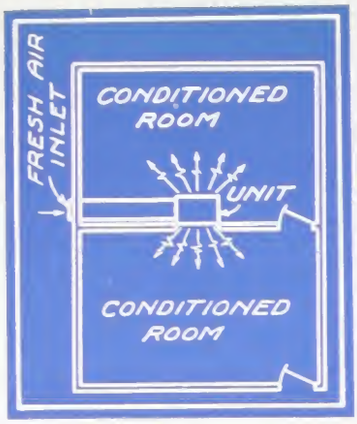
Complete air conditioning means independent and simultaneous control of temperature, humidity, cleanliness, fresh air supply, and air motion. For summer air conditioning, obviously, cooling the air, partly drying it, and properly distributing it through circulation are items of first importance.

It develops that the principles of air conditioning most generally used for human comfort can be grouped under a few main headings. The five main systems described in the following pages are typical of most modern installations using finned coil surface in the air system.

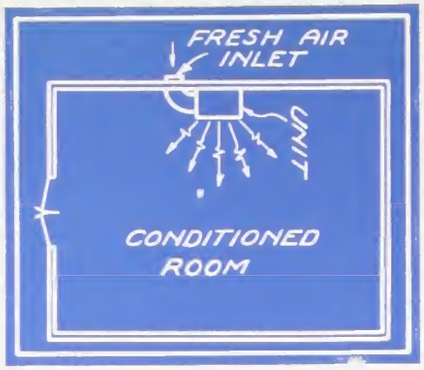
These systems may be further classified under three principles: first, simple correction of dry bulb temperature and partial control of moisture content; second, complete and independent control of temperature and humidity by cooling variable proportions of the air; third, the same complete control by cooling all the air down to the desired dew point and then reheating it to get the proper humidity and temperature in the conditioned space. Each principle has special applications as shown in the following pages.

Capacity control can be added to any of these systems, by the use of either vari-speed fan-motor pulleys, two-speed compressor motors, or unloading devices on the compressors.

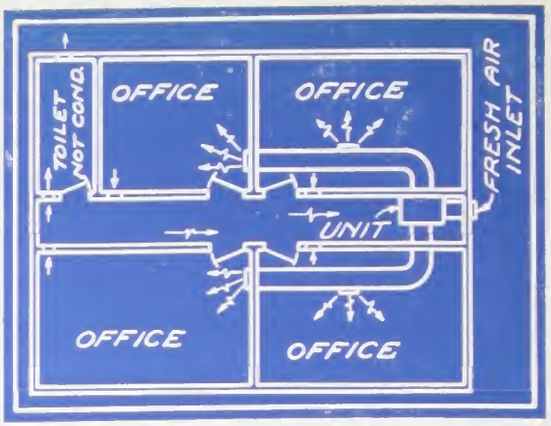
BULLETIN No. 505-B



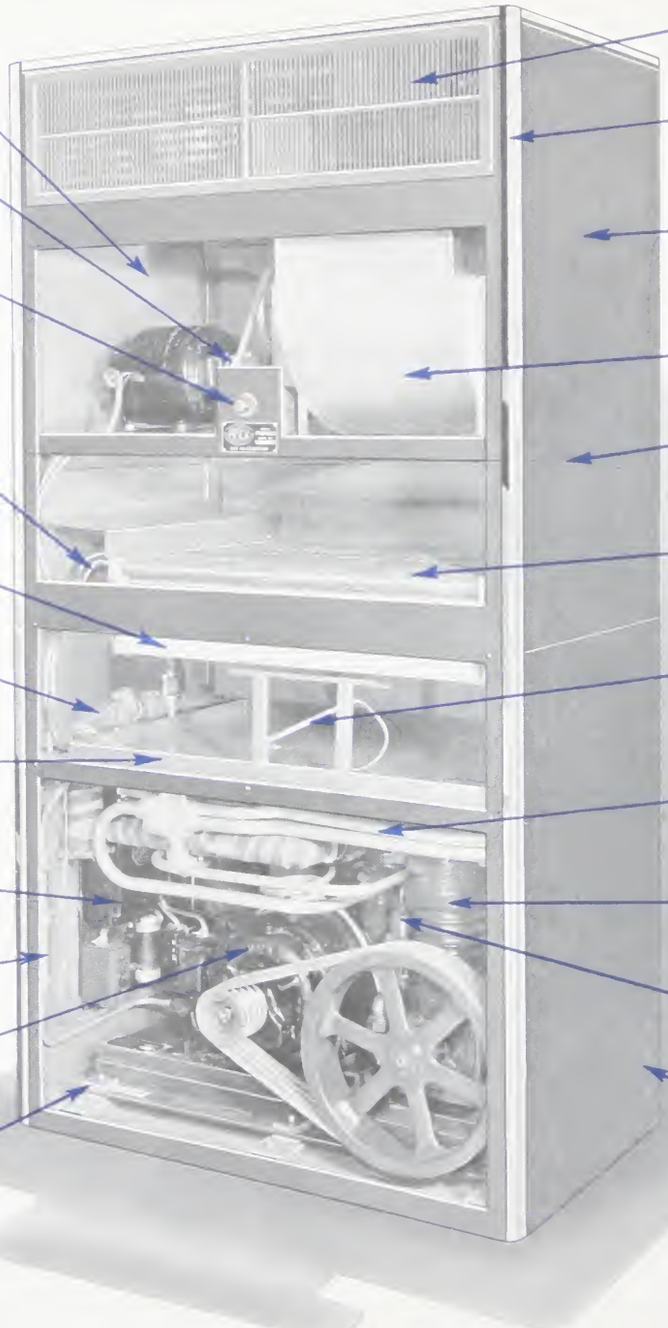
One Unit Here Serves Two Rooms



Unit Located at Side of Space to be Cooled



Unit Arranged for Air Conditioning a Suite of Rooms



½" Sound and Heat Insulation, Fire Resistant.

Fan Motor has Vari-speed Pulley.

Selector Switch at Eye Level Gives Convenient, Economical Operation.

Alco Thermal Expansion Valves with 8 Individual Feeds to Coil Circuit.

Air Filter, easily Removed, Cleaned and Replaced.

Insulated Suction Line Prevents Drippage.

Drip Pan with Drain Carries off Excess Moisture Condensed from Air.

All Electric Controls Mounted on Panel.

Filter in Liquid Freon-12 Line.

Motor Driving the Compressor is Water Cooled.

Rubber Mounted Base Frame.

Small Floor Space Required: $40\frac{3}{4}$" x $23\frac{3}{4}$" for Model 312 and $42\frac{3}{4}$" x $26\frac{3}{8}$" for Model 518.

Adjustable Louvers Direct Air to Either Side, Up or Down, Outward or Converging.

Stainless Steel Trim.

Sides of 14-gauge Steel, Finished in Roxylin Enamel. Panels Permit Changing Grills or using Ducts.

Quiet Blower Type Fan of Large Capacity.

Top Section Removable.

Four Rows of Finned Cooling Coils, with Suction Drier Coil Below.

Thermostat Controls Operation of Refrigerating Plant.

Condenser with Water in Outside Pipes Carries Heat from Machine Space.

Large Slow-speed Refrigerating Machine.

Automatic Valve Regulates Water as Needed.

Knock-outs for Connections on Sides and Back.

Removable Panels Permit Instant Access to Interior Parts, as Illustrated.

Superior Features of Frick Unit Air Conditioners

Unit Air Conditioners

APPLICATION

Stores, restaurants, offices, banks, beauty and barber shops, industrial plants and other places requiring a cooling system of moderate capacity, with temperature and approximate relative humidity control, find these Frick Units the answer to a long-felt need. They are equally suitable for public spaces in average-sized hotels, including lobbies, dining rooms, coffee shops, tap rooms, specialty shops, and small meeting halls.

DESCRIPTION

The general design of these Units provides an all-in-one or self-contained air conditioner that can be handled in one or two pieces. Completely assembled, charged and tested at the Frick Factory, the Units can in nearly every case be put into operation without interrupting business. They can be moved as easily as other fixtures.

Adjustable louvers are provided behind the air outlet grilles, permitting the air stream to be directed up or down, as well as to either side.

The condenser is of the double-pipe type, with the copper tubes wound in two flat coils, which are mounted above the motor. The cold water runs between the inside and outside of these coils and hence carries away heat collected from the machinery space in the Unit. For the same reason the main motor is enclosed in a cold water jacket.

CONTROL

All the electric controls are mounted on a panel inside of the cabinet. This panel is wired, in turn, to a small 3-way switch on the front. When turned to the right, the dial points to the station marked "cool," and both the refrigerating unit and the air fan are started. The refrigerating machine will then run automatically under the control of the thermostat in the room.

When the dial is turned to the station marked "fan," the blower provides continuous circulation of air in the room but the refrigerating machine is inactive. When the dial is in the central or "off" position, both the refrigerating machine and the fan are stopped.

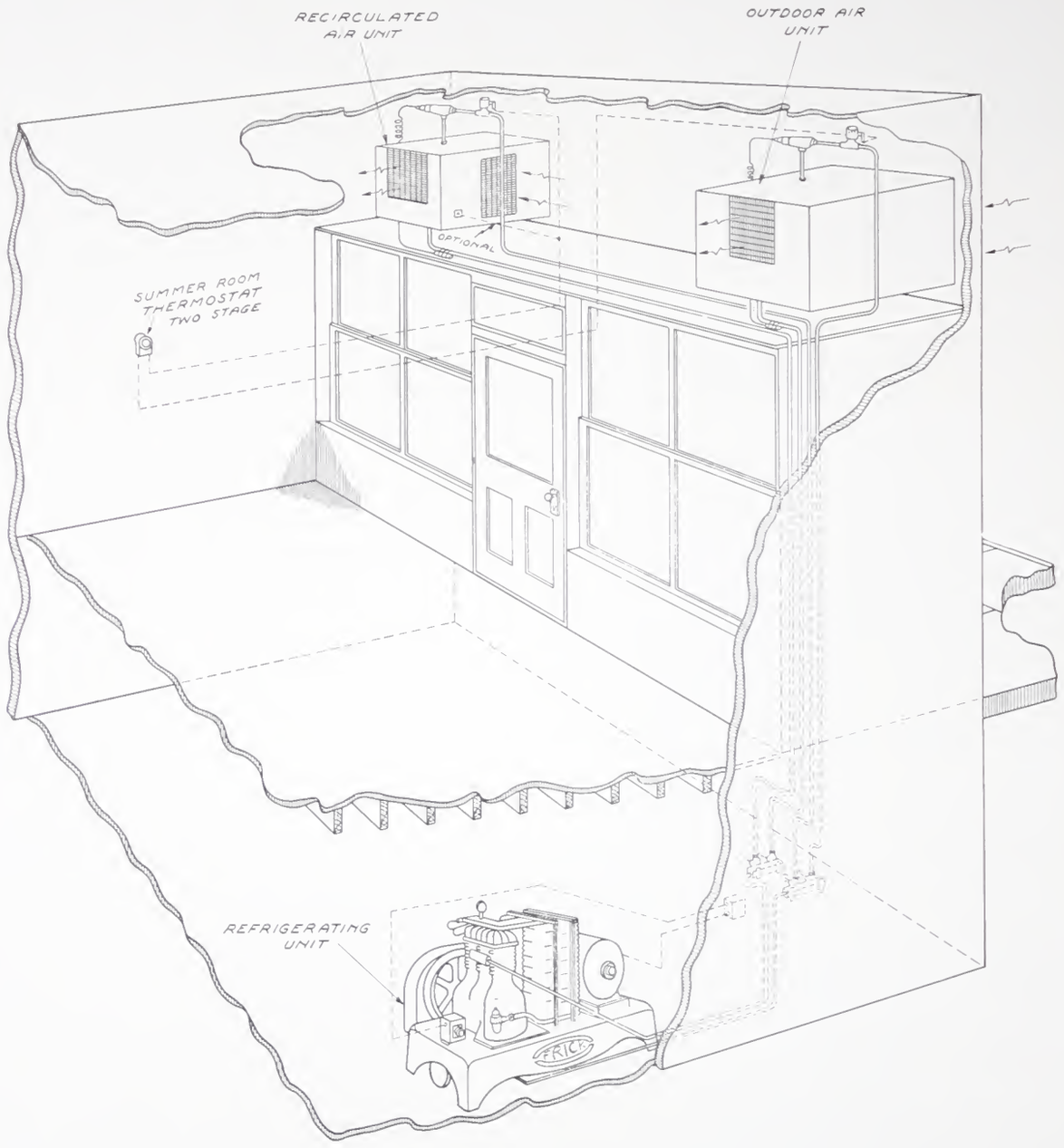
OPERATION

The air is drawn into the Conditioner through the grilles at the middle; fresh air is preferably admitted through the back or one side, the long opening at the middle front being intended for recirculated air. Both the fresh and recirculated air pass through a filter, where dust, pollen, soot, and bacteria are removed. The cleaned air next goes over the fins and the tubes of the cooling coils, where excess moisture is taken out, and the temperature is lowered an average of 15 to 20 degrees. Finally the air enters the blower, from which it is discharged through the grilles at the top of the Unit, into the room. The speed of the fan can be varied from full capacity to two-thirds, as needed, to carry the load to best advantage. By reducing the amount of air handled, the coils can be kept colder and the air made drier than when a larger quantity is in circulation. The fan operates continuously to provide ventilation, and to filter and recirculate the air.

ADVANTAGES

of Frick Unit air conditioners are shown in the illustration opposite.

The Units can be installed in a few hours time, it being only necessary to connect the power, water, and drain lines, and to fit in place any ducts wanted.



THE MULTIPLE UNIT SYSTEM (Patented). Note Units for Recirculated and Fresh Air Distribution. The Air Can Enter Either Directly, as Shown, or Through Separate Ducts.

The Moose Club of Erie, Penna., is Air Conditioned with the Multiple Unit System Described Below. Fresh Air Duct Appears at Right: Duct for Recirculated Air is above the Lights at Left.

The Multiple Unit System

APPLICATION

Recommended for smaller stores, restaurants, offices and installations of 30 hp. and under; where relative humidity may be permitted to vary within the comfort zone. The patented two-stage control permits use of this system where temperature control only would be inadequate.

DESCRIPTION

In this system air motion and distribution are maintained all the time by keeping the fans on both units in continuous operation. One unit handles the fresh air required for ventilation and leakage, the other unit handles only recirculated air.

CONTROL

The necessary refrigeration is controlled by a two-stage thermostat, or two separate thermostats set several degrees apart. Electrically operated valves are placed in the liquid Freon-12 lines to each unit and are wired to contacts of the thermostat. The first instrument making contact opens the valve on the unit handling fresh air. The second contact controls the valve on the unit handling recirculated air. (There may be two units for recirculated air but a larger number is not good practice).

OPERATION

The operation of the compressor is controlled by a pressurestat in the Freon-12 suction line. As the amount of refrigeration needed rises or falls under varying loads, so does the suction pressure increase or decrease. The fluctuations of the suction pressure start and stop the compressor through the pressurestat.

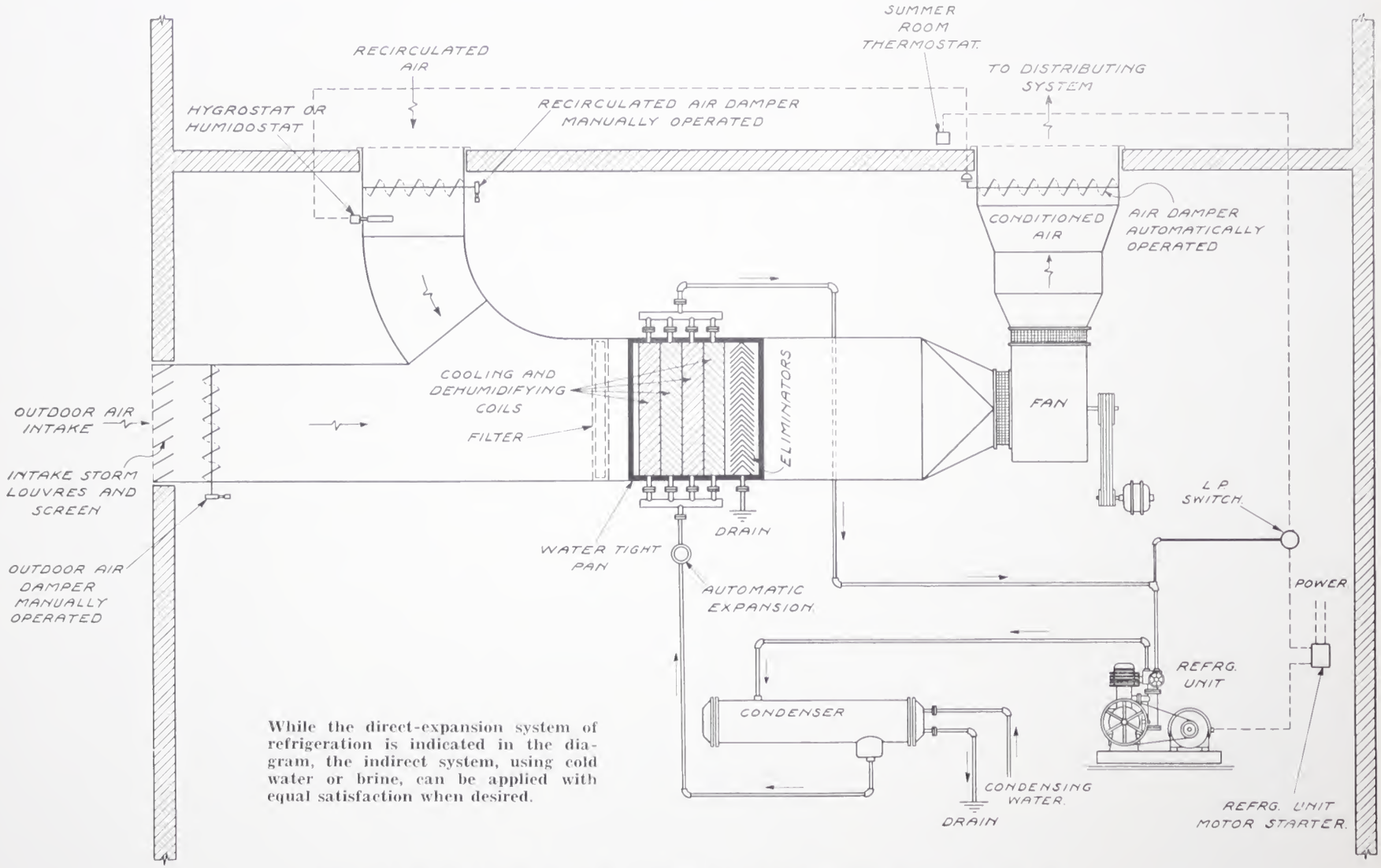
ADVANTAGES

This arrangement keeps the relative humidity in the conditioned space from rising during periods of mild outside temperature, at the same time keeping the dry bulb temperature constant. It is economical in first cost and operation—it does a better job than a single unit system, without independent control of relative humidity.

The reasons for this are that, under partial load, "less air is cooled through a wider range"; also, because the compressor is run only when refrigeration is required, and under efficient operating pressure; and finally because the initial cost is less than other systems more applicable to larger installations.

More than 30 claims have been allowed under the two patents listed, which individually and collectively permit all these advantages to be grouped into one system.

This system is patented by Frick Co. (Nos. 2,104,851 and 2,112,520.)



While the direct-expansion system of refrigeration is indicated in the diagram, the indirect system, using cold water or brine, can be applied with equal satisfaction when desired.

THE CONTROLLED AIR VOLUME SYSTEM, Showing Arrangement and Use of Each Part. Volume of Air Entering the Distributing System can be Reduced to 70 per cent of Maximum Fan Capacity.

This 10-story Building at Topeka, Kansas, uses the Controlled Air Volume System for Keeping the many Offices Comfortable.

The Controlled Air Volume System

APPLICATION

This system works best where there is not much moisture to be taken out of the air, which means that the latent heat is a relatively small proportion of the total load. Office buildings, where the main load is removal of sensible heat, representing leakage through walls or radiation from lights, have, therefore, used this system very successfully.

DESCRIPTION

In this system the proportions of recirculated and outside air are regulated by means of manually operated dampers. The mixture is pulled through the cooling coils by the fan and discharged through an automatically operated damper into the distributing system. This damper may vary air volume about 30 per cent, or between 70 and 100 per cent of the fan capacity. The distributing system for the conditioned air must, therefore, be able to handle these varying quantities of air satisfactorily without creating drafts or pockets.

CONTROL

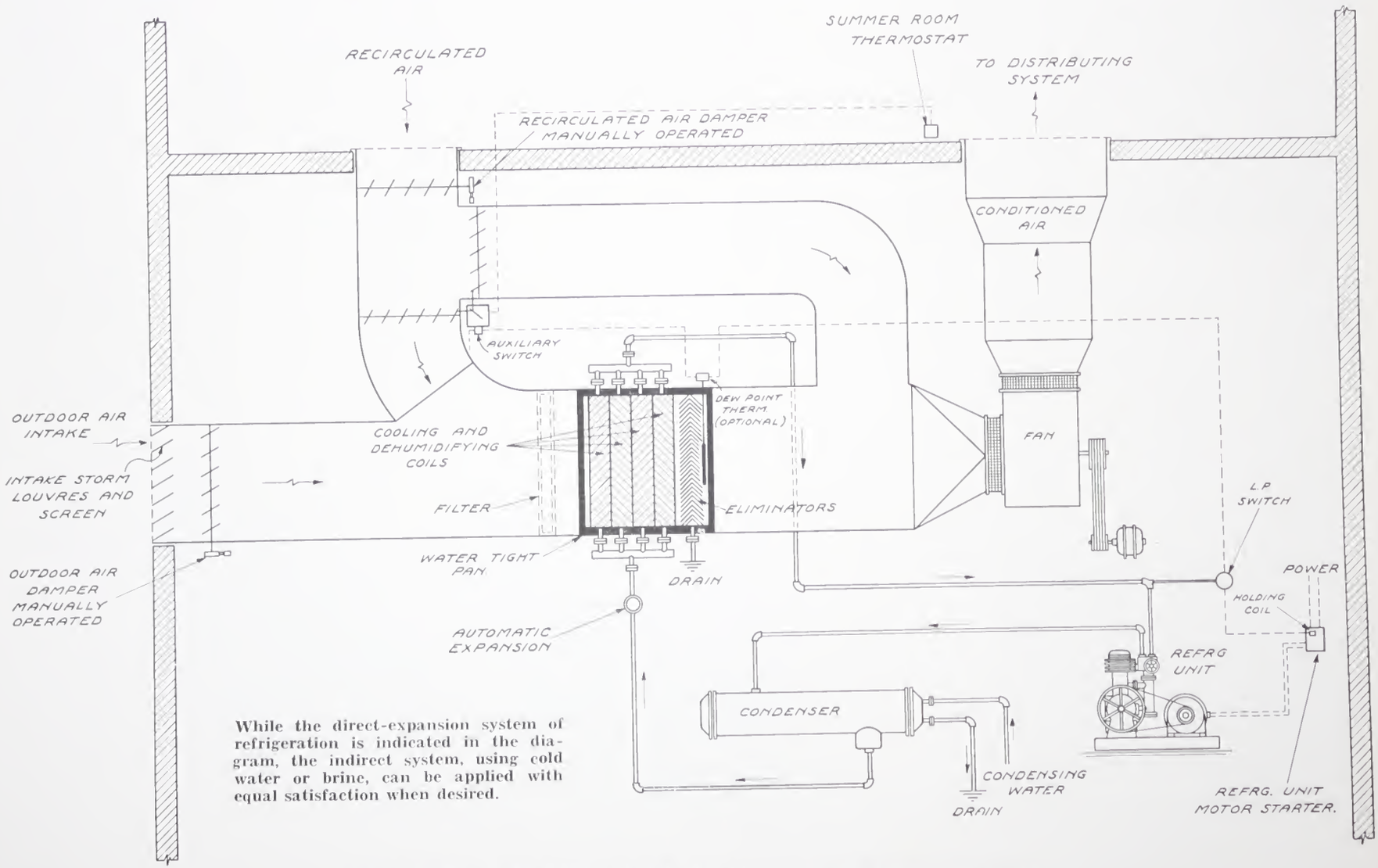
The refrigeration is controlled by a thermostat in the conditioned space, which starts and stops the compressor. Automatic safety controls are installed to stop the compressor in case of too high or too low operating pressures. The humidity is controlled through the humidistat which operates the damper in a discharge air duct, regulating the volume of air circulated.

OPERATION

As the dry bulb temperature varies, the thermostat regulates refrigeration supplied. As the humidity rises, the automatic damper is closed. This cools "less air through a wider range," reducing the relative humidity in the conditioned space. As the humidity falls, the damper is opened, narrowing the cooling range and reducing the quantity of moisture condensed out of the air.

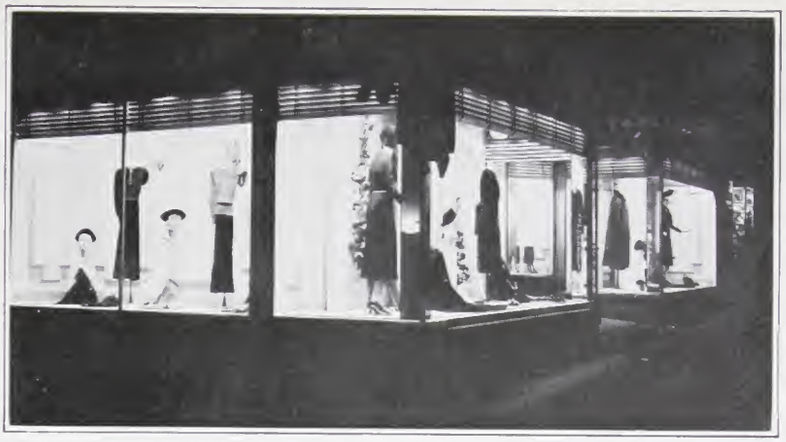
ADVANTAGES

This system gives more accurate control of humidity than the preceding system and does its regulating automatically. The controls are simple. In spaces where individual cooling units are not desired, or are impractical due to the size of the conditioned space, this system is inexpensive to install, requires little attention, and when properly proportioned is economical in operation.



While the direct-expansion system of refrigeration is indicated in the diagram, the indirect system, using cold water or brine, can be applied with equal satisfaction when desired.

THE AUTOMATIC BY-PASS SYSTEM (Patented by the Auditorium Conditioning Corp.) One of Several Typical Combinations Offered.



A Typical Department Store Equipped with Frick Air Conditioning, using the Automatic By-Pass System.

The Automatic By-pass System

APPLICATION

This system is recommended for high latent heat loads, caused by emission of moisture from large groups of people, from cooking and hot foods, or where quantities of water vapor are generated from any source. It is recommended for large restaurants, theaters, auditoriums, or wherever there is a high concentration of people.

DESCRIPTION

In this system the proportions of recirculated and outside air are regulated by means of manually operated dampers, as is the case with the Controlled Air Volume System; here, however, there is an automatic by-pass around the cooling coils, the amount of air circulated through this by-pass being governed by a motor-operated damper in the by-pass duct. The by-pass damper varies the air passed through the cooling coils about 60 per cent, or between 40 and 100 per cent of the fan capacity. At the same time it maintains constantly the total volume of air circulated by the fan through the distributing system.

A modulating thermostat in the treated area operates a modulating motor on the by-pass damper so that an infinite number of positions may be held between the open and closed positions. This varies the amount of air by-passed around the cooling coil as the temperature fluctuates.

CONTROL

The refrigeration is controlled by an auxiliary switch on the motor-operated damper, which stops the compressor when the by-pass damper is opened wide, and starts it when this damper is closed or partially closed. The humidity is controlled indirectly by the variation in the amount of air by-passed around the cooling coils. A dew-point thermostat may be wired in series with the auxiliary switch on the automatic damper if desired. The usual safety features are also incorporated in the compressor control.

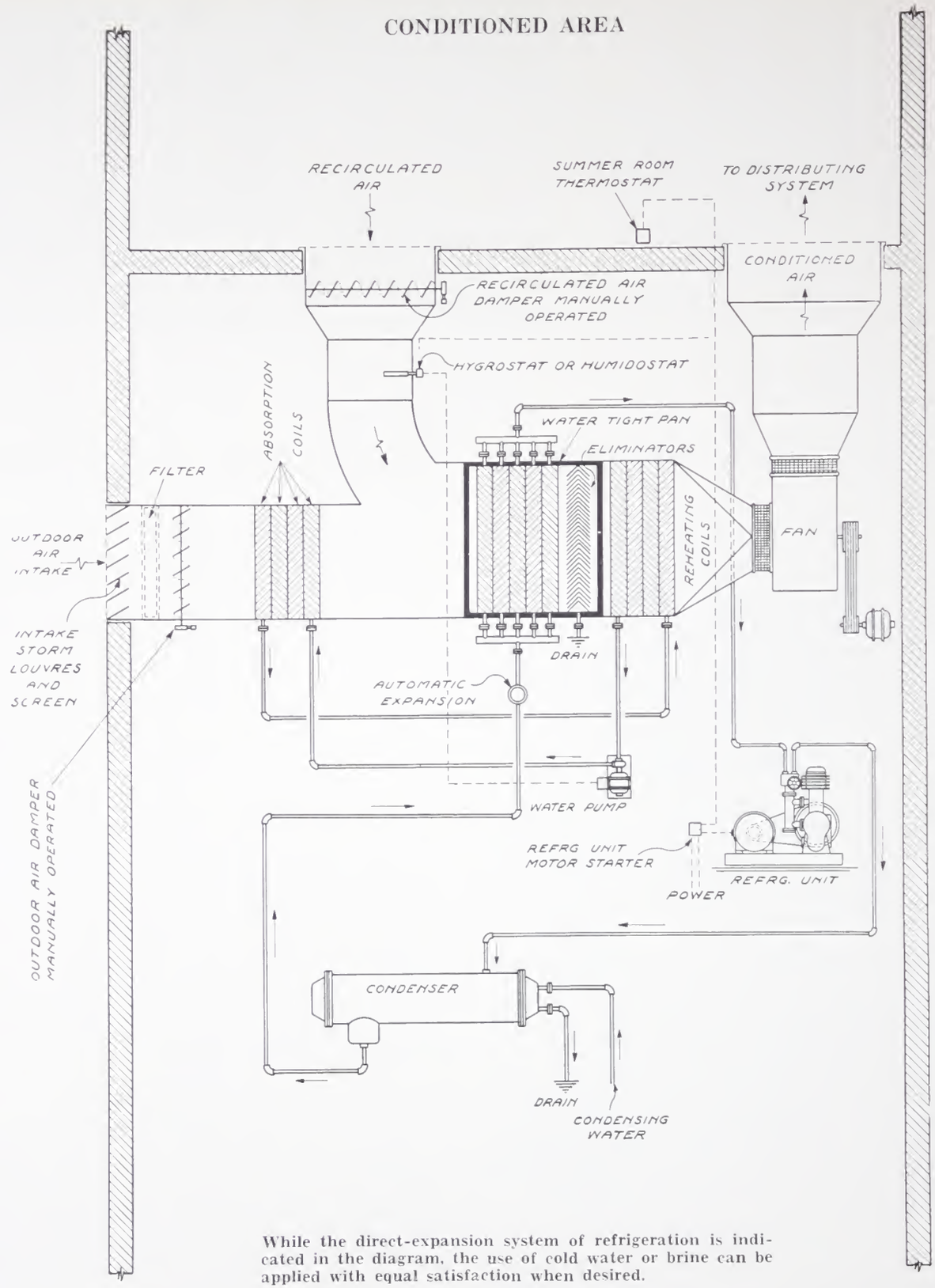
OPERATION

When the air temperature in the conditioned area is high, the thermostat closes the by-pass damper and circulates all the air through the cooling coils. As the temperature drops, the by-pass damper is gradually opened until the temperature reaches the lower limit when all the air is by-passed around the cooling coils, and the refrigeration is shut off. In this system also, under partial loads "less air is cooled through a wider range." If a dew-point thermostat is furnished, it will keep the compressor shut down even though the by-pass damper is partially open, if the dew-point of the air is low enough to produce the desired humidity. This saves refrigeration and prevents the humidity from dropping below the point necessary for comfort.

ADVANTAGES

Due to its ability to vary more widely the quantity of air passed over the cooling coils, more latent heat can be removed than with the previously described systems. Distribution problems are reduced by circulating a constant volume of air: this is especially important on jobs having a multitude of small rooms.

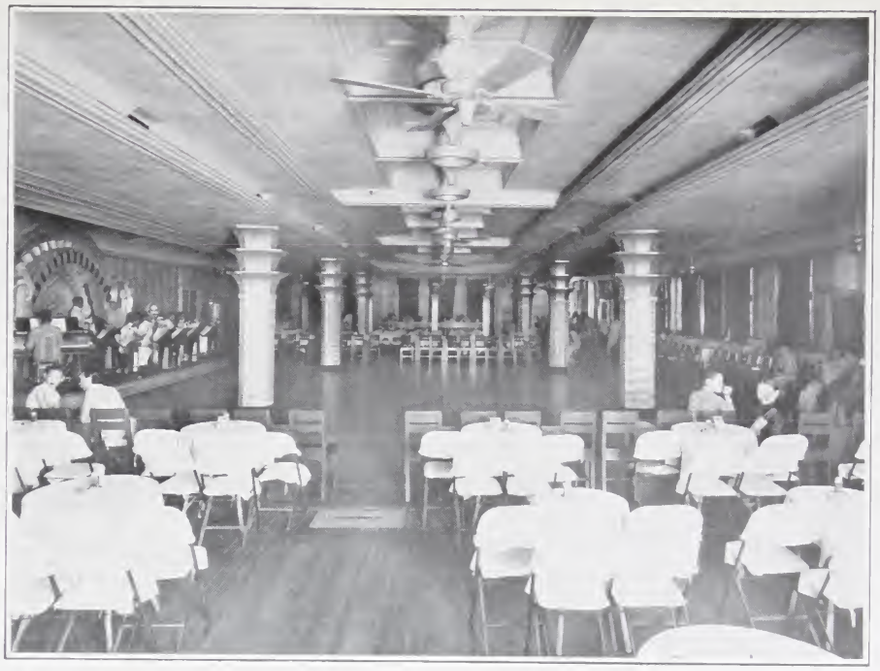
Frick Company is a regular Licensee of the Auditorium Conditioning Corporation's patents, and we will be glad to supply complete information about them.



While the direct-expansion system of refrigeration is indicated in the diagram, the use of cold water or brine can be applied with equal satisfaction when desired.

The Direct System Makes Possible the Most Accurate Control of Air Conditions.

This Shanghai Cabaret is the Type of Hall to which the Direct System Applies Most Advantageously.



The Direct System

APPLICATION

This system is of special use where the latent heat load is a large part of the total load and where the total load is high in comparison with volume of air circulated. Auditoriums having a high occupancy factor and low ceilings are conditioned most satisfactorily by the Direct System. It is recommended for any kind of installation where "the ultimate" is desired in effective results.

DESCRIPTION

In this system also the fresh air intake and the recirculated air ducts contain manually operated dampers. The volume of air circulated is constant and all of it passes over the refrigerating coils. The air is cooled low enough to condense out of it sufficient moisture to give the required humidity. If the resulting air temperature is too low, the reheating coils raise it to the desired point.

CONTROL

A thermostat in the conditioned area operates the compressor according to temperature requirements. A humidistat in the recirculated air return duct operates a water pump which supplies warm water to the reheating coils. The standard automatic and safety controls are furnished for the compressor.

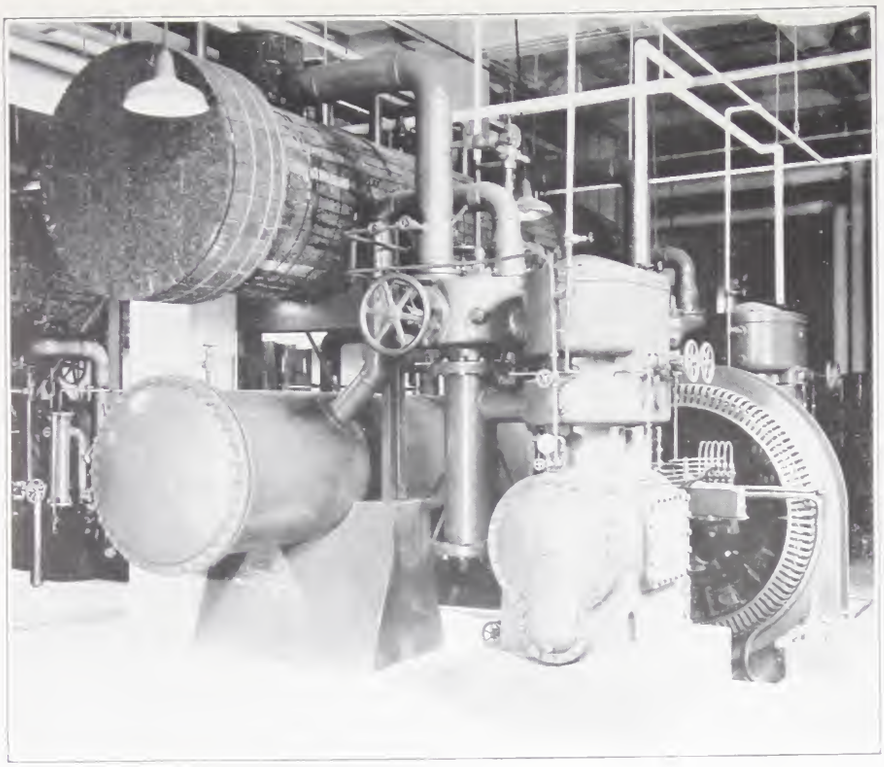
OPERATION

The Direct System varies from the operation of the other three systems. This system cools "all the air and then reheats it." When the humidity rises to the maximum desired, the pump starts circulating water through the coils, absorbing heat from the incoming fresh air. From these coils the warm water is discharged through the reheating coils which raises the temperature of the cooled air and lowers its relative humidity. If the inside temperature rises above the desired point, the thermostat starts the compressor, which produces cooled and dehumidified air. When the thermostat circuit is completed it also completes a circuit through the humidistat: this in turn starts the water pump on the absorption-reheating cycle, in case the inside humidity rises above the maximum permitted. This condenses moisture out of the air and the air with lowered dew point is then reheated to obtain desired relative humidity inside.

ADVANTAGES

The accurate control of air conditions possible with this arrangement can hardly be duplicated with any other system. Properly dehumidified air can be produced at a dry bulb temperature within 3 degrees of the dry bulb temperatures of the recirculated air or 6 degrees of the outside dry bulb, whichever dry bulb is higher. On mild days it prevents refrigeration being shut off before proper dehumidification has been obtained, and prevents unduly low temperatures occurring when dehumidification is obtained. Because of the coils, pump and connections in the absorption reheat cycle, the initial cost is higher than the other systems. It is a DeLuxe System but where an accurately controlled job is required capable of successfully handling heavy and varying loads it is worth the price.

In Air Conditioning as in other things you get what you pay for.



One of Two Frick Water Cooling Units, each Comprising a Pair of 15 by 10 "Freon-12" Compressors, Used for Air Conditioning the Federal Home Owners Loan Building, Washington, D. C.

Four Frick 12″ by 12″ Ammonia Compressors Supply Over 1000 Tons of Refrigeration for Cooling Water to Air Condition the Philcade and Philtower Buildings in Tulsa, Okla.

Cooling With Chilled Water

All of the previous systems have shown the refrigerant expanding directly into the finned cooling coils, with liquid and suction mains running to each cooling point. In many large installations long refrigerant lines result in extreme pressure drops which reduce efficiency. In other cases, lines carrying gaseous refrigerants are not desired.

Safety codes for refrigerating systems restrict the quantity of total refrigerant charge permitted in direct expansion systems. This prohibits the use of such systems where tonnage requirements are large.

In all such instances, chilled water is provided for circulation through the refrigerating sections of the coils in the air streams. Water cooling systems generally include one or more compressors, shell-and-tube water coolers, shell-and-tube condensers, and necessary automatic controls for compressor operation and feeding refrigerant. In such cases it may be advantageous to use ammonia or carbon dioxide as the primary refrigerant.

As builders of equipment for all the commercial refrigerants, Frick Company is in an unbiased position in recommending or manufacturing the system that is best suited to any particular need. Many fine installations of each type can be shown, using our equipment.

Our experience and facilities are available to owners, contractors, architects, and engineers interested in applying either direct-expansion or cold-water refrigerating systems to any air conditioning problem.

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FRICK CO.

WAYNESBORO, PENNA. U.S.A.

Printed in U. S. A.

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